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Description

This invention relates to disc brake assemblies and more particularly to disc brake assemblies with floating calipers - the invention will be particularly described with reference to pad guided disc brake assemblies, but it is to be understood that the invention may be used with other types of assemblies, such as pin guided disc brake assemblies.

Braking of motor vehicles sets up considerable stresses in the brake components which accordingly deflect, to a greater or lesser extent depending on the loading on, and nature of the particular component. By way of explanation, Figure 1 of the attached drawings depicts diagrammatically a prior art disc brake assembly 1 under braking conditions. The disc brake assembly 1 includes a caliper 2 on the inboard side of which a cylinder 3 is integrally formed. A piston (not shown) is slidable within the cylinder 3 and is connected to an inboard pad assembly 4. An outboard pad assembly 5 is connected to the outboard side of the caliper 2 and the two pad assemblies are arranged to clamp onto a disc 6 which is mounted to rotate with the motor vehicle on which the assembly is mounted. An anchor bracket 7 is fixed to the vehicle and slideways 8 are formed on the anchor bracket. The slideways 8 serve to support and guide the pad assemblies 4 and 5 under braking conditions. As shown in an exaggerated manner in Figure 1, there is a tendency for the anchor bracket 7 to deflect under load which in turn results in the caliper 2 tilting relative to the axis of rotation of the disc and hence uneven loading being applied by the pad assemblies. The friction pads 9 of the pad assemblies tend to taper after continued use and this leads to brakes off, brake drag and reduced performance due to skew pad pressure distribution. Reduced pad life also results.

This problem applies to the caliper of both pad guided or pin guided constructions. This problem can be reduced to some extent by making the anchor bracket less deflectable by, for example, providing a tie bar (indicated by dotted lines 10) on the outboard side of the bracket, or alternatively making the anchor bracket stronger. Both these solutions result in an anchor bracket which is substantially heavier than is desirable, and is accordingly more expensive. The weight factor is important since there is a need to keep vehicle weight as low as possible to thereby enhance vehicle operational characteristics. It has also been found that, although the deflection is reduced using either of these solutions, deflection does still occur which is undesirable.

A further disadvantage of prior art disc brake assemblies is complexity of manufacture, limited possibilities to utilise assemblies in a variety of vehicles, high cost of manufacture, and high weight.

A further problem arises as a result of vehicle variations. It will be appreciated that motor vehicles require a brake system which is specifically adapted to complement the characteristics of that vehicle, and accordingly, where disc brakes are used, disc diameters and brake components are selected to complement each particular model of vehicle. Motor vehicle manufacturers now produce wide ranges of models having differing weights and speeds and accordingly, it has been necessary to produce a wide range of disc brake assemblies. The necessity to provide this range adds significantly to the cost of assemblies, particularly where a particular assembly is only required for a short production run, as the capital outlay needed to produce a particular assembly has to be recouped from only a limited number of items.

It is an object of the invention to provide a disc brake assembly in which the above-mentioned pad taper problem is diminished to a significant extent. A further object is to provide a caliper which allows for a light weight disc brake assembly. A yet further object of the invention is to provide a disc brake assembly suitable for use on a variety of vehicles which requires only minimum adaptation for different vehicles.

GB-A-2012896 proposes one solution to the problem of irregular pad wear wherein a backing plate of the outboard pad is provided with a raised rib which bears against outboard fingers of the caliper bridge so as to act something in the manner of a fulcrum.

DE-A-3347387, acknowledged in the precharacterising portion of the following independent claim, proposes another solution to the problem of uneven pad wear wherein the caliper is resiliently deflectable under braking conditions, the exit side of the caliper being caused to be more flexible than the entry side so that the brake clamping force on the exit side is less than that on the entry side.

According to the invention, however, there is provided a disc brake assembly engageable with a disc rotatably mounted on a vehicle, and supported on an anchor bracket mounted in fixed relation to the vehicle, comprising a caliper including a bridge and a cylinder, said bridge having an inboard portion and an outboard portion on opposite sides of the disc, said inboard and outboard portions being connected by a central portion, said cylinder being mounted to said inboard portion with a piston being slidably mounted in said cylinder, and inboard and outboard friction pad assemblies being provided having planar faces capable of being brought into frictional contact with opposite faces of said disc, said caliper being resiliently deflectable under braking conditions, characterised in that said resil-

ient deflection under braking conditions is such that the outboard portion of said caliper resiliently deflects relative to said inboard portion in a direction transverse to the axis of said cylinder and parallel to the direction of movement of said disc at the region where said friction pad assemblies are in engagement with said disc.

Various embodiments of the invention will now be described by way of examples, reference being made to the accompanying drawings:

Figure 1 shows a prior art disc brake assembly in diagrammatic plan view.

Figure 2 shows a perspective view of one embodiment of a disc brake assembly according to the invention.

Figure 3 shows a plan view of Figure 2 under braking conditions.

Figures 4A and 4B show a bridge and pot assembly during and after the assembly of those two components.

Figure 5 shows a perspective view of a bridge and enlargements depicting the connection between the bridge and the pot.

Figures 6 and 7 show side views of alternative location of abutments between the bridge and the pot.

Figure 8 shows a perspective view of a second embodiment of the invention.

Figure 9 shows a sectional view along line IX-IX of Figure 8.

Figure 10 shows a perspective view of a third embodiment of the invention.

Figure 11 shows a perspective view of a fourth embodiment of the invention.

Figure 12 shows a side view of a disc brake assembly according to the invention operable with a narrow disc.

Figure 13 shows a side view of a disc brake assembly operable with a wide disc.

Figure 14 shows a cross-sectional end view through a bridge according to the invention.

Figures 15A and 15B show the manner in which the outboard backing plate attaches to the bridge.

Figure 16 shows an end view of a disc brake assembly depicting a further manner of attachment of the outboard backing plate to the bridge.

Figure 17 shows an end view of a two caliper brake assembly.

Figure 18 shows a perspective view of a yoke type caliper according to the invention.

A disc brake assembly according to the invention can be constructed in various ways. As shown in Figure 2, caliper 11 includes a bridge 12 having an inboard portion 13 and an outboard portion 14, those two portions being joined by a central portion 15. The form of bridge 12 depicted in Figure 2 has two substantially symmetrical sections 16 and 17 each of substantially inverted U-shaped form, the two sections 16 and 17 being joined together at the outboard side 14 of the bridge 12 by a web 18. The inboard side 13 of the bridge has a cylinder 19 mounted thereto, that cylinder 19 generally being known as a pot. The pot 19 has hydraulic fluid connections 20 for supplying pressurized fluid to the cylinder, and a piston 21 is slidable within the cylinder for operating the brakes. The caliper 11 includes an inboard friction pad assembly 22 and an outboard friction pad assembly 23. An anchor bracket 24 is adapted to be mounted to a motor vehicle by mounting holes 25 and the bracket 24 has slideways 26 on either side thereof in which the ends 27 of the pad assemblies 22, 23 slide.

The bridge 12 is preferably formed from a resilient steel material so that the central portion 15 can flex in a direction parallel to the pads under braking conditions. Figure 3 depicts the manner in which the bridge 12 is able to deflect, although the Figure 3 deflection is exaggerated for ease of description.

The deflection of the bridge 12 in this specification is referred to as being in a "lateral" direction. The term "lateral" is to be understood as meaning substantially transverse to the axis of rotation of the disc with which the brake assembly is to be used, and substantially parallel to the circumference of that disc at the region where the pad assemblies contact the disc. "Axial" deflection on the other hand means perpendicular to lateral deflection and parallel to the axis of the disc, i.e., in the direction of the axis of the caliper cylinder. It is desirable that axial deflection be kept low.

As shown in Figure 3 the inboard and outboard pad assemblies 22, 23 are clamping onto a disc 29 which is rotating in the direction of arrow 30. Because of the cantilever nature of the anchor bracket 24 the slideway 26 on which the ends 27 of the pad assemblies are bearing tilts relative to the axis of rotation of the disc 29. The outboard pad assembly 23 thus moves a distance equal to the deflection of the slideway 26, but because the slideway 26 is tilting, the distance the outboard pad 23 moves is greater than the distance the inboard pad 22 moves. The difference between the distances which the two pads move is depicted by the dimension D in Figure 3. To accommodate this difference in movement the central portion 15 of the bridge 12 deflects. The outboard portion 14 deflects a greater distance than the inboard portion 13, the difference in those deflections being depicted by the dimension d. Preferably dimensions D and d are equal and the friction pad assemblies 22, 23 remain parallel with the faces of the disc 29. In this manner tapered wear of the friction facings of the pad assemblies is at least substantially

avoided even though the centre lines 31, 32 of the forces applied by each of the pad assemblies are not co-linear.

It will be appreciated that it is still important for the bridge 12 to be substantially rigid in an axial direction, that is, the planes of the backing plates 35 of the pad assemblies must be kept parallel. If the inboard and outboard portions of the bridge 12 were able to splay under load there would be a tendency for the radially outer edges 36 of the friction facings 32 to wear more rapidly than the radially inner edges. The bridge 12 depicted in Figures 2 and 3 obtains this axial rigidity by the manner in which it is formed. It will be noted that the depth (measured radially) of the central portion 15 of each of the two sections 16 and 17 is greater than the width (measured in the circumferential or lateral direction) of those sections. The two sections are also angled slightly relative to each other such that the plane of each section 16, 17 is substantially aligned with a radius of the disc with which the brake assembly is to be used.

A further important aspect of the invention is the manner in which the bridge 12 is connected to the pot or cylinder 19. The inboard portion 13 is preferably formed in the manner of a pair of cranked arms 37 which hold the pot 19 between them. The manner in which the pot 19 is held can vary although it is important that no tilting of the pot relative to the bridge 12 about an axis joining the two connecting abutments is able to occur. In one preferred arrangement the cranked arms 37 are biased towards each other and clamp the pot 19 between them. As depicted in Figure 2 the bridge 12 is formed from plate steel of uniform thickness cut into a C-shaped form and bent to the required configuration. The free ends of that C-form form the cranked arms 37. The arms 37 of the bridge 12 prior to assembly with the pot 19 are spaced apart a distance which is less than the width of the pot. Once the pot is forced into position between the arms 37 the resilience of the material from which the bridge is made ensures that the pot 19 is firmly clamped between the cranked arms 37.

Figures 4A and 4B depict the assembly procedure. As shown in Figures 4A and 4B the pot 19 is located between the two sections 16 and 17 and is pushed in the direction of arrow 40. Tapered surfaces 41 on the inboard side of the pot urge the cranked arms 37 apart (see arrow 38) and allows the pot 19 to locate between the arms 37. A recess 42 is defined on each side of the pot 19 and the arms 37 snap into those recesses when the pot 19 is pushed home.

A tapered surface 43 on the inboard side of each recess 42 engages each of the cranked arms (as shown in enlarged view 44 of part of Figure 3) to urge an alignment surface 45 on each arm 37 into engagement with an abutment surface 46 on each side of the pot 19. Thus, the bias force on the two arms 37 towards each other is directed by the tapered surfaces 43 to cause the alignment surface 45 on each arm to firmly engage and seat on the abutment surface 46 on the pot 19. Arrows 47 depict the manner of this force.

As mentioned previously, it is important that the pot 19 is held square to the bridge 12, that is, the axis of the cylinder within the pot is perpendicular to the plane of the backing plates 35. The engagement between surfaces 45 and 46 holds the pot square with the bridge.

Figure 5 shows another possible practical arrangement by which this is achieved. As shown, the alignment surface 50 on the right hand cranked arm 49 is of slightly convex form so that the surface 50 only touches the abutment surface 46 on the pot at a single small zone. The left hand abutment surface 51 is, however, square so as to square up with the abutment surface 46 on the lefthand side of the pot. The aforementioned bias force thus holds the two alignment surfaces 50, 51 in firm engagement with their respective abutments 46 and thus the pot in correct alignment with the bridge. The rounded form of the alignment surface 50 means that only one of the surfaces 50, 51 needs be machined square with the pot. The convex surface 50 is in firm contact with its abutment 46 but the two surfaces 50, 51 do not need to be square with each other, and the two abutment surfaces can also be slightly skewed. Provided alignment surface 51 is properly square the bridge 12 will be correctly aligned with the pot 19.

Although the invention aims at click fitting of pot and bridge to reduce parts and simplify manufacturing and assembly, suitable fasteners such as pins, rivets or screws can be used to permanently secure the bridge and pot together if so desired.

An advantage of having the pot 19 and bridge 12 formed as separate components is that variations in the brake assembly which are necessary to accommodate vehicle differences can be obtained by altering only one of the components. In the preferred arrangement it is envisaged that the pot 19 will be varied to suit a particular vehicle whilst the bridge 12 will remain unaltered for a range of vehicles covering differing disc diameters and thicknesses. For example, where a high braking force is required this can be achieved by boring the cylinder in the pot 19 to a larger diameter and using a correspondingly larger piston 21. Generally, it is envisaged that most conventional variations will be accommodated by simply boring the cylinder in the pot 19 to the required diameter and/or casting the abutments on the pot at different positions. The pot 19 and bridge 12 can be formed

of different materials which can lead to a saving in the expensive alloy materials from which the pot is usually cast. The absence of the bridge from the pot makes boring of the pot easier to do, and simplifies piston insertion and testing operations.

Alternative arrangements for ensuring the pot and bridge 12 are in proper alignment with each other are depicted in Figures 6 and 7. Figure 6 shows an arrangement in which a lug 55 on the pot has an upper surface 56 which serves as an abutment surface for an alignment surface 57 formed on the lower side of a recess 58 in the cranked arm 59 of a bridge 12. Figure 7 shows an arrangement in which an abutment surface 62 on a lug 60 on the pot 19 engages with an alignment surface 61 formed on the underside of the central portion of the bridge 12. Clearly, other arrangements are also possible.

Figures 8 and 9 depict an alternative arrangement of bridge, and an alternative method of securing the bridge to the pot. As shown, a pot 70 of similar form to that described above is connected to a bridge 71 formed of two substantially identical sections, 72 and 73. Both sections have an inboard portion 74, a central portion 75 and an outboard portion 76. The outboard portions 76 each have a downwardly directed finger 77 for engagement with an outboard backing plate, whilst the inboard portions each have a cranked arm 78 which are mounted on opposite sides of the pot 70. Once again, the two sections of the bridge are axially rigid, that is, the rigidity is such that the fingers 77 and cranked arms 78 are unable to move apart under braking load.

The bridge 71 is connected to the pot 70 in a pivotal manner. This will be more clearly understood with reference to Figure 9. Each cranked arm 78 is held to its respective side of the pot 70 by means of a high strength stud 79. The studs are resiliently flexible and may be hollow, and are located in holes 80 formed in side wings 81 which are integral with the pot. The inboard faces 82 of the wings 81 serve as abutment surfaces for the bridge 71. Each face 83 of each cranked arm 78 has an elongate, convex rounded recess 84 formed therein and, on each arm 78, the stud 79 locates within that recess 84 to hold the arm 78 to the side of the pot 70. The contact between pot and arm 78 is against the inside rounded recess 84 as shown in Figure 9. It will be appreciated that the bridge 71 will be able to tilt relative to the pot 70 due to the flexible nature of the studs 79. The rounded form of the recesses 84 facilitates that assembly.

With the construction shown in Figures 8 and 9 there will be lateral flexibility between pot and bridge permitting parallel movement and engagement of the pad assemblies (not shown) so that those pad assemblies avoid the tapered wear problems referred to above with reference to Figure 1. However, the axial rigidity ensures that no taper occurs in a radial direction.

Figure 10 depicts a yet further embodiment. As shown in that drawing the pot 90 and bridge 91 can be made integral. The bridge 91 may include a central portion 92 formed of two parallel integral bridge elements or beams 93 having depths which are greater than their widths and which are thus more flexible in a lateral direction than in an axial direction. Fingers 94 are integrally formed with the central portion 92 on the outboard side of the bridge 91.

Figure 11 depicts a further embodiment which is similar to that shown in Figure 10 except that the bridge 95 depicted in Figure 11 is of more complex construction than that of Figure 10. The caliper 95 includes a central portion 96 having a multi-element, frame like construction, the frame elements 97 having relatively small cross-sectional areas. As shown, the frame elements 97 are each of substantially square cross-sectional configuration at their mid points. Each frame element 97 does not itself necessarily have a stiffness which is greater in the radial direction than in the lateral direction. However, by virtue of the interactive arrangement of the elements, the caliper has a stiffness which is far greater in the radial direction than in the lateral direction. The frame elements 97 act in a composite manner to thereby permit lateral flexing under braking load. The fingers 98 of the bridge 95 are of significantly greater cross-sectional thickness than the frame elements 97 and this increased thickness provides the bridge with axial rigidity. A transverse beam 99 also of substantial cross-section on the outboard side of the bridge 95 ensures the frame elements 97 act in a composite manner. The bridge 95 is integral with the pot 100 and is preferably formed from a lightweight metal or alloy.

Figures 12 and 13 depict two different arrangements of disc brake assemblies, Figure 12 showing an assembly 105 for use with a narrow thickness disc 110 whilst Figure 13 depicts an assembly 106 for use with a wider thickness disc 111. In each of the two assemblies 105 and 106 the bridge 107 is identical. Differences in thickness of disc is accommodated by the manner in which the bridge 107 attaches to the respective pot 108 or 109.

As shown in Figure 12 the bridge connects to the pot 108 at a position towards the inboard side 112 of the pot 108. Locating lugs 113 and abutments 114 ensure the bridge 107 and pot 108 are properly aligned in the manner referred to above. The piston 115 is thus positioned relatively close to the fingers 116 of the bridge 107 on the outboard side of the bridge 107.

The arrangement shown in Figure 13 is different in that the connection between the bridge

107 and the pot 117 is towards the centre of the pot 109. The pot 109 is thus further from fingers 117 on the outboard side of the caliper compared with the Figure 12 arrangement permitting a wider disc 111 to be used.

Clearly, width differences in discs can be accommodated in different ways, for example, by having differing length pistons. However, differences for example in lug positions between Figures 12 and 13 are easily accommodated in the casting of the pot.

Figure 14 depicts how a bridge 120 of the general type under discussion can be used with discs 121, 122 of differing diameters. A wide range of discs can thus be accommodated.

Figures 15A and 15B depict the manner in which the outboard pad assembly 130 connects to the outboard side of bridge 131. It will be noted that bridge 131 is similar to that described with reference to Figures 2 to 7 above. Bridge 131 has a pair of fingers 132 on the outboard side thereof joined by web 133. The inboard face of fingers 132 each have a rectangular groove 134 formed therein, those grooves 134 being aligned in a direction which is substantially parallel with the circumference of the disc with which the caliper 131 will be used. A spring clip 135 attached to the rear face 136 of backing plate 137 of pad assembly 130 is used to connect the pad assembly 130 to the web 133. Two lugs 139 are formed on the rear face 136 of the backing plate 137 and those lugs 139 are arranged to locate in the grooves 134. The interaction between the lugs 139 and grooves 134 limits the extent to which the pad assembly 130 can move relative to bridge 131. As shown in Figure 15B the pad assembly 130 is able to rotate and move radially slightly relative to the bridge 131, the limit of that rotation and translation being defined by the relative dimensions of the grooves 134 and lugs 139.

The backing plate 137 also has a flange 140 which projects in an outboard direction and in an assembled condition locates between the fingers 132. Interaction between the fingers 132 and the flange 140 will limit the extent to which the outboard pad assembly 130 can move in a lateral direction relative to the bridge 131. Both the rotational and translational movements described above are for pad initial alignment to the bridge during installation.

An alternative arrangement to that shown in Figures 15A and 15B is shown in Figure 16. As shown, a bridge 150 supports a pad assembly 151 having a backing plate 152. The backing plate 152 is connected and biased to a web 153 of the bridge by a spring 154 which is secured to the backing plate by rivet 155. The frictional resistance to relative movement between the backing plate 152 and the web 153 provides a slip joint connection between those two components. The backing plate is prevented from moving upwardly by a U-shaped lower portion 156 of the spring 154 and is prevented from moving downwardly by side portions 157 of the spring 154. However, due to the designed clearance between the spring 154 and web 157 some permanent movement of the backing plate upwards and downwards is possible. Upstanding lugs 158 on the upper edge 159 of the backing plate 152 engage with the central portion 160 of the bridge 150 with side clearance to provide limits for the pad assembly 151 moving laterally relative to the bridge. An anti-rattle spring 161 acts between the anchor bracket 162 and one of those upstanding lugs 158. The ends 163 of the backing plate 152 slide in slideways 164 formed on the anchor bracket 162.

Figure 17 depicts a high performance application of the brake assembly. As shown, an anchor bracket 170 has two relatively widely spaced slideways 171. A pair of elongate pad assemblies 172 have ends 173 which slide in those slideways. Twin bridges 174 and pots 175 act on the pad assemblies. The bridges 174 can be of a form substantially identical to that shown in Figures 2 to 7 and the manner of attachment between bridges 174 and pots 175 can be similar to the arrangements described hereinbefore.

Lastly, as shown in Figure 18, a yoke type caliper 180 is shown. The caliper 180 is comprised of metal plate having an inboard portion 181, a central portion 182, and an outboard portion 183. A cylinder assembly 184 is mounted to the inboard portion 181 and friction pad assemblies 185 are arranged to engage opposite faces of a disc or rotor 186. An elongate slot 187 is formed in the caliper 180 to enable the caliper 180 to fit over the disc 186 as shown in the drawing. The central portion 182 is formed by two web like strips 188 at each end of the slot 187. The strips 188 are integral with the inboard and outboard portions 181 and 183 and are formed of the same thickness metal plate as the inboard and outboard portions. However, the width of the strips 188 as depicted by dimension line "d" is significantly narrower than prior art yokes of this type so that, under braking conditions, the outboard portion 183 of the caliper 180 will be resiliently deflectable laterally relative to the inboard portion 181 thereof. The width of the strips 188 will be determined by the degree of flexibility required and by strength requirements of the caliper.

Claims

1. A disc brake assembly engageable with a disc (29) rotatably mounted on a vehicle, and sup-

ported on an anchor bracket (24) mounted in fixed relation to the vehicle, comprising a caliper (11) including a bridge (12) and a cylinder (19), said bridge (12) having an inboard portion (13) and an outboard portion (14) on opposite sides of the disc, said inboard and outboard portions being connected by a central portion (15), said cylinder (19) being mounted to said inboard portion (13) with a piston being slidably mounted in said cylinder (19), and inboard (22) and outboard (23) friction pad assemblies being provided having planar faces capable of being brought into frictional contact with opposite faces of said disc (29), said caliper (11) being resiliently deflectable under braking conditions, characterised in that said resilient deflection under braking conditions is such that the outboard portion (14) of said caliper (11) resiliently deflects relative to said inboard portion (13) in a direction transverse to the axis (32) of said cylinder (19) and parallel to the direction of movement of said disc (29) at the region where said friction pad assemblies (22, 23) are in engagement with laid disc (29).

2. A disc brake assembly according to claim 1, characterised in that a pair of relatively spaced slideways (26) are formed on said anchor bracket (24) arranged facing each other and substantially parallel to the axis of the disc (29) with which the brake is to be used, an inboard and an outboard backing plate (35) being attached in supporting relation to a respective friction pad, each backing plate (35) having end portions each terminating in an abutment portion (27) slidable in one of said slideways (26), said anchor bracket (24) being resiliently deflectable under load applied by said backing plate abutment portion (27) such that said slideways (26) under load move out of parallel alignment with said disc axis, and said caliper (11) being resiliently deflectable such that said planar faces of said friction pad assemblies (22, 23) are maintained parallel to their respective faces of the disc whilst said abutment portions (27) remain in contact with said out of alignment slideways (26).

3. A disc brake assembly according to claim 1 or 2, characterised in that said central portion (15) is resiliently flexible.

4. A disc brake assembly according to claim 1 or 2, characterised in that said inboard portion (13) of said caliper is mounted to said cylinder (70) by a resiliently biased pivotal connection (79, 84), the resilient bias of said connection biasing said inboard and outboard portions into alignment with the axis of said cylinder (70).

5. A disc brake assembly according to any preceding claim, characterised in that the stiffness of the bridge in an axial direction is significantly greater than the stiffness of the bridge in a lateral direction.

6. A disc brake assembly according to any preceding claim, characterised in that the bridge (12, 80) is formed from metal plate material bent into an appropriate form.

7. A disc brake assembly according to any preceding claim, characterised in that the inboard portion of said bridge (12) is comprised of a pair of arms (37) spaced apart by a certain dimension, and joined together at a position remote from said inboard portion, said cylinder (19) having a lateral dimension which is greater than said certain dimension, said cylinder (19) being mounted to said bridge (12) by said arms (37) resiliently clamping onto opposite sides of said cylinder (19) to hold said cylinder therebetween.

8. A disc brake assembly according to claim 7, characterised in that said cylinder has a pair of shoulders formed thereon, an abutment surface (46) being formed on each shoulder, and each said arm (37) has an alignment surface (45) formed thereon, said alignment surfaces (45) being held in engagement with said abutment surfaces (46) to thereby operatively align said cylinder (19) and said bridge (12).

9. A disc brake assembly according to claim 8, characterised in that each side of said cylinder has a tapered surface (43) thereon facing towards said abutment surface (46), and said tapered surfaces (43) act on said arms (37) to urge said alignment surfaces (45) into engagement with said abutment surfaces (46).

10. A disc brake assembly according to claim 8 or 9, characterised in that one said alignment surface (51) is flat and the other alignment surface (50) is convex.

11. A disc brake assembly according to claim 1 or 2, characterised in that said bridge (91, 95) and cylinder (90, 100) are integrally formed, said inboard, outboard and central portions of said bridge (91, 95) being comprised of frame elements (93, 97) integrally formed with each other so as to act in a composite manner.

12. A disc brake assembly according to claim 11, characterised in that said central portion (96) comprises at least three parallel frame elements (97) joined integrally at the inboard portion of the bridge to said cylinder (100), and joined together at the outboard portion by a beam (99) extending transverse to the length of said frame elements (97), said beam having greater rigidity in a direction perpendicular to said disc axis than said frame elements (97).

13. A disc brake assembly according to any preceding claim, characterised in that said outboard pad assembly (130) is rotatable relative to said bridge (131) to a limited extent about an axis which is parallel to the axis of the disc with which said brake assembly is to be used.

14. A disc brake assembly according to claim 13, characterised in that said outboard portion is comprised by a pair of fingers (132) joined together, and the inboard side of said fingers each have a groove (134) formed therein, the outboard side of the outboard pad assembly having a pair of outwardly facing lugs (139) thereon each of which locates in a respective one of said grooves (134), said lugs and grooves coacting to limit rotation and radial movement of said outboard pad assembly relative to said bridge.

15. A disc brake assembly according to claim 14, characterised in that said outboard pad assembly has an outwardly directed flange (140) thereon which locates between said fingers (132) and limits the extent to which said pad assembly can move laterally relative to said bridge.

16. A disc brake assembly according to one of claims 13 to 15, characterised in that a bias spring (154) acts between said outboard portion and said outboard backing plate to urge said outboard backing plate (152) into frictional contact with said outboard portion, said bias spring (154) functioning to provide limits for radial and axial rotation of said backing plate relative to said outboard portion.

Patentansprüche

1. Scheibenbremsenanordnung, die mit einer Scheibe (29), die drehbar an einem Fahrzeug gelagert ist, in Anlage bringbar ist und auf einer Ankerklammer (24) gelagert ist, die in fester Beziehung zu dem Fahrzeug gelagert ist, mit einem Sattel (11), der eine Brücke (12) und einen Zylinder (19) aufweist, wobei die Brücke (12) einen innenliegenden Abschnitt (13) und einen außenliegenden Abschnitt (14) auf gegenüberliegenden Seiten der Scheibe aufweist und die innenliegenden und außenliegenden Abschnitte über einen Mittenabschnitt (15) miteinander verbunden sind, der Zylinder (19) an dem innenliegenden Abschnitt (13) mit einem Kolben gelagert ist, der gleitbeweglich in dem Zylinder (19) gelagert ist, und wobei innenliegende (22) und außenliegende (23) Reibungskissenanordnungen bzw. Reibungsbelaganordnungen vorgesehen sind, die ebene Oberflächen aufweisen, die in Reibschluß mit gegenüberliegenden Flächen der Scheibe (29) bringbar sind, wobei der Sattel (11) im Bremszustand federnd auslenkbar ist, dadurch gekennzeichnet, daß die federnde Auslenkung im Bremszustand solchermaßen ist, daß der außenliegenden Abschnitt (14) des Sattels (11) relativ zu dem innnenliegenden Abschnitt (13) in einer Richtung quer zur Achse (32) des Zylinders (19) und parallel zur Bewegungsrichtung der Scheibe (29) in dem Abschnitt ausgelenkt wird, wo die Reibungsbelaganordnungen (22, 23) in Anlage mit der Scheibe (29) sind.

2. Scheibenbremsenanordnungen nach Anspruch 1, dadurch gekennzeichnet, daß ein Paar von relativ zueinander beabstandeten Gleitbahnen (26) auf der Ankerklammer (24) ausgebildet sind, die so einander zugewandt und im wesentlichen parallel zu der Achse der Scheibe (29) angeordnet sind, mit welcher die Bremse zu verwenden ist, wobei eine innenliegende und eine außenliegende Stützplatte (35) in stützender Anordnung für den betreffenden Reibungsbelag befestigt ist, wobei jede Stützplatte (35) Endabschnitte aufweist, die je in einem Anlageabschnitt (27) enden, der in je einer Gleitbahn (26) gleitbeweglich ist, daß die Ankerklammer (24) elastisch unter Belastung auslenkbar ist, die durch den Stützplatten-Anlageabschnitt (27) derart angelegt wird, daß die Gleitbahnen (26) unter Belastung sich aus der parallelen Ausrichtung zu der Scheibenachse herausbewegen, und daß der Sattel (11) federnd derart auslenkbar ist, daß ebene Flächen der Reibungsbelaganordnungen (22, 23) parallel zu ihren jeweiligen Scheibenflächen gehalten werden, während die Anlageabschnitte (27) in Anlage mit den unausgerichteten Gleitbahnen (26) verbleiben.

3. Scheibenbremsenanordnung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Mittenabschnitt (15) elastisch biegsam ist.

4. Scheibenbremsenanordnung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der innenliegende Abschnitt (13) des Sattels durch eine federnd vorgespannte Schwenk verbindung (79, 84) an dem Zylinder (70) gelagert ist, wobei die federnde Vorspannung der Verbindung die innen liegenden und außenliegenden Abschnitte in Ausrichtung zu der Achse des Zylinders (70) vorspannt.

5. Scheibenbremsenanordnung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Steifheit der Brücke in axialer Richtung beträchtlich größer als die Steifheit der Brücke in einer seitlichen Richtung ist.

6. Scheibenbremsenanordnung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Brücke (12, 80) aus einem Metallblechmaterial gebildet ist, das in eine geeignete Form gebogen ist.

7. Scheibenbremsenanordnung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der innenliegende Abschnitt der Brücke (12) aus einem Paar Arme (37) besteht, die um einen bestimmten Abstand voneinander beabstandet sind und an einer Stelle fern des innenliegenden Abschnitts miteinander verbunden sind, wobei der Zylinder (19) eine Seitenabmessung aufweist, die größer als der bestimmte Abstand ist, der Zylinder (19) an der Brücke (12) durch die Arme (37) gelagert ist, die federnd gegenüberliegende Seiten des Zylinders (19) festhalten, um den Zylinder zwischen diesen zu halten.

8. Scheibenbremsenanordnung nach Anspruch 7, dadurch gekenn zeichnet, daß der Zylinder ein Paar von Schultern, die auf diesem ausgebildet sind, und eine Anlageoberfläche (46) aufweist, die auf jeder Schulter ausgebildet ist, und jeder Arm (37) eine Ausrichtoberfläche (45) aufweist, die auf diesem ausgebildet ist, wobei die Ausrichtoberflächen (45) in Anlage mit den Anlageoberflächen (46) gehalten werden, um den Zylinder (19) und die Brücke (12) im Betrieb auszurichten.

9. Scheibenbremsenanordnung nach Anspruch 8, dadurch gekennzeichnet, daß jede Seite des Zylinders eine konische Oberfläche (43) auf diesem aufweist, die zu der Anlageoberfläche (46) weist, und daß die konischen Oberflächen (43) auf die Arme (37) wirken, um die Ausrichtoberflächen (45) in Anlage mit den Anlageoberflächen (46) zu drücken.

10. Scheibenbremsenanordnung nach Anspruch 8 oder 9, dadurch gekennzeichnet, daß die eine Ausrichtoberfläche (51) flach und die andere Ausrichtoberfläche (50) konvex ist.

11. Scheibenbremsenanordung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Brükke (91, 95) und der Zylinder (90, 100) einstükkig ausgebildet sind und die innenliegenden, außenliegenden und mittleren Abschnitte der Brücke (91, 95) aus Rahmenelementen (93, 97) bestehen, die einstückig miteinander ausgebildet sind, so daß sie in einer Verbundart wirken.

12. Scheibenbremsenanordnung nach Anspruch 11, dadurch gekennzeichnet, daß der Mittenabschnitt (96) mindestens 3 parallele Rahmenelemente (97) aufweist, die einstückig an dem innenliegenden Abschnitt der Brücke mit dem Zylinder (100) verbunden sind und an dem außenliegenden Abschnitt durch einen Balken (99) verbunden sind, der sich quer zur Länge des Rahmenelements (97) erstreckt, wobei der Balken eine größere Festigkeit in einer Richtung senkrecht zu der Scheibenachse als die Rahmenelemente (97) aufweist.

13. Scheibenbremsenanordnung, nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die außenliegende Belaganordnung (130) relativ zu der Brücke (131) in einem begrenzten Ausmaß um eine Achse drehbeweglich ist, die parallel zur Achse der Scheibe ist, mit welcher die Bremsenanordnung zu verwenden ist.

14. Scheibenbremsenanordnung nach Anspruch 13, dadurch gekennzeichnet, daß der außenliegende Abschnitt ein Paar miteinander verbundene Finger (132) aufweist und die innenliegende Seite der Finger je eine Nut (134) aufweist, die darin ausgebildet ist, und die außenliegende Seite der außenliegenden Belaganordnung ein Paar von nach auswärts weisenden Vorsprüngen (139) auf dieser aufweist, von denen jeder in je einer der Nuten (134) angeordnet ist, wobei die Vorsprünge und Nuten zusammenwirken, um die Drehung und die radiale Bewegung der außenliegenden Belaganordnung relativ zu der Brücke zu begrenzen.

15. Scheibenbremsenanordnung nach Anspruch 14, dadurch gekennzeichnet, daß die außenliegende Belaganordnung einen auswärtsgerichteten Flansch (140) auf diesem aufweist, der zwischen den Fingern (132) angeordnet ist und das Ausmaß begrenzt, bis zu welchem die

Belaganordnung sich seitlich relativ zu der Brücke bewegen kann.

16. Scheibenbremsenanordnung nach einem der Ansprüche 13 bis 15, dadurch gekennzeichnet, daß eine Vorspannungsfeder (154) zwischen dem außenliegenden Abschnitt und der außenliegenden Stützplatte wirkt, um die außenliegende Stützplatte (152) in Reibanlage mit dem außenliegenden Abschnitt zu drücken, wobei die Vorspannungsfeder (154) so arbeitet, daß sie Begrenzungen für die radiale und axiale Drehung der Stützplatte relativ zu dem außenliegenden Abschnitt schafft.

Revendications

1. Frein à disque destiné à coopérer avec un disque (29) monté afin qu'il puisse tourner sur un véhicule et supporté par une ferrure (24) d'ancrage montée en position fixe sur le véhicule, le frein comprenant un étrier (11) qui comporte un pontet (12) et un cylindre (19), le pontet (12) ayant une partie interne (13) et une partie externe (14) placées de part et d'autre du disque, les parties interne et externe étant raccordées par une partie centrale (15), le cylindre (19) étant monté sur la partie interne (13) alors qu'un piston est monté dans le cylindre (19) afin qu'il puisse coulisser, et des patins interne (22) et externe (23) de friction ayant des surfaces planes qui peuvent être mises en contact par friction avec les faces opposées du disque (29), l'étrier (11) pouvant fléchir élastiquement dans les conditions de freinage, le frein étant caractérisé en ce que le fléchissement élastique dans les conditions de freinage est tel que la partie externe (14) de l'étrier (11) fléchit élastiquement par rapport à la partie interne (13) en direction transversale à l'axe (32) du cylindre (19) et parallèle à la direction de déplacement du disque (29) dans la région dans laquelle les patins de friction (22, 23) sont au contact du disque (29).

2. Frein à disque selon la revendication 1, caractérisé en ce que deux glissières espacées (26) sont formées sur la ferrure d'ancrage (24) afin qu'elles soient tournées l'une vers l'autre et soient sensiblement parallèles à l'axe du disque (29) avec lequel le frein est destiné à être utilisé, une plaque interne et une plaque externe (35) d'appui étant fixées à un patin respectif de friction et le supportant, chaque plaque d'appui (35) ayant des parties d'extrémité aboutissant chacune à une partie de butée (27) qui peut coulisser dans l'une des glissières (26), la ferrure d'ancrage (24) pouvant fléchir élastiquement sous l'action d'une force appliquée par la partie (27) de butée de plaque d'appui de manière que les glissières (26), sous charge, se déplacent en s'écartant de l'alignement de parallélisme avec l'axe du disque, et l'étrier (11) pouvant fléchir élastiquement de manière que les faces planes des patins de friction (22, 23) soient maintenues parallèles aux faces respectives du disque alors que les parties de butée (27) restent au contact des glissières désalignées (26).

3. Frein à disque selon la revendication 1 ou 2, caractérisé en ce que la partie centrale (15) peut fléchir élastiquement.

4. Frein à disque selon la revendication 1 ou 2, caractérisé en ce que la partie interne (13) de l'étrier est montée sur le cylindre (70) par un raccord pivotant (79, 84) qui est rappelé élastiquement, le rappel élastique du raccord assurant le rappel des parties interne et externe dans l'alignement de l'axe du cylindre (70).

5. Frein à disque selon l'une quelconque des revendications précédentes, caractérisé en ce que la rigidité du pontet en direction axiale est nettement supérieure à la rigidité du pontet en direction latérale.

6. Frein à disque selon l'une quelconque des revendications précédentes, caractérisé en ce que le pontet (12, 80) est formé d'une plaque métallique courbée à une configuration convenable.

7. Frein à disque selon l'une quelconque des revendications précédentes, caractérisé en ce que la partie interne du pontet (12) est formée de deux bras (37) séparés par une certaine distance et raccordée à un emplacement distant de ladite partie interne, le cylindre (19) ayant une dimension latérale supérieure à ladite distance, le cylindre (19) étant monté sur le pontet (12) par serrage élastique des bras (37) sur les côtés opposés du cylindre (19) afin que celui-ci soit maintenu entre eux.

8. Frein à disque selon la revendication 7, caractérisé en ce que le cylindre a deux épaulements, une surface (46) de butée étant formée sur chaque épaulement, et chaque bras (37) a une surface d'alignement (45), les surfaces d'alignement (45) étant maintenues au contact des surfaces de butée (46) afin que le cylindre (19) et le pontet (12) soient alignés pendant le fonctionnement.

9. Frein à disque selon la revendication 8, caractérisé en ce que chaque côté du cylindre a une surface inclinée (43) tournée vers la surface de butée (46), et les surfaces inclinées (43) agissent sur les bras (37) afin que les surfaces d'alignement (45) soient repoussées au contact des surfaces de butée (46).

10. Frein à disque selon la revendication 8 ou 9, caractérisé en ce qu'une surface d'alignement (51) est plate et l'autre (50) est convexe.

11. Frein à disque selon la revendication 1 ou 2, caractérisé en ce que le pontet (91, 95) et le cylindre (90, 100) sont formés en une seule pièce, les parties interne, externe et centrale du pontet (91, 95) étant formées d'éléments de châssis (93, 97) formés en une seule pièce afin qu'ils agissent de manière composite.

12. Frein à disque selon la revendication 11, caractérisé en ce que la partie centrale (96) comporte au moins trois éléments parallèles (97) de châssis raccordés afin qu'ils soient solidaires du cylindre (100) à la partie interne du pontet et soient raccordés ensemble à la partie externe par une poutre (99) disposée transversalement à la longueur des éléments de châssis (97), la poutre ayant une rigidité en direction perpendiculaire à l'axe du disque qui est supérieure à celle des éléments de châssis (97).

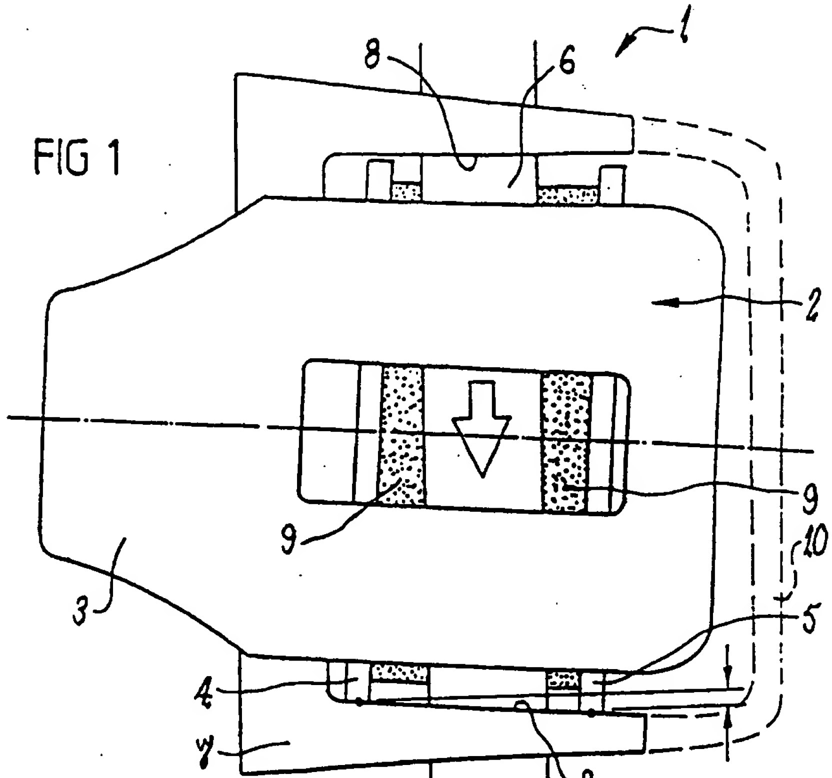
13. Frein à disque selon l'une quelconque des revendications précédentes, caractérisé en ce que le patin externe (130) peut tourner par rapport au pontet (131) sur une amplitude limitée autour d'un axe qui est parallèle à l'axe du disque avec lequel le frein doit être utilisé.

14. Frein à disque selon la revendication 13, caractérisé en ce que ladite partie externe est formée par deux doigts (132) raccordés l'un à l'autre, et le côté interne des doigts porte une gorge (134), le côté externe du patin externe ayant deux pattes (139) tournées vers l'extérieur et qui se positionnent chacune dans une gorge respective (134), les pattes et les gorges coopérant afin qu'elles limitent la rotation et le déplacement radial du patin externe par rapport au pontet.

15. Frein à disque selon la revendication 14, caractérisé en ce que le patin externe a un flasque (140) tourné vers l'extérieur et qui se positionne entre les doigts (132) et limite l'amplitude de déplacement possible du patin en direction latérale par rapport au pontet.

16. Frein à disque selon l'une des revendications 13 à 15, caractérisé en ce qu'un ressort de rappel (154) agit entre ladite partie externe et la plaque externe d'appui afin qu'il repousse la plaque externe d'appui (152) en contact par friction avec ladite partie externe, le ressort de rappel (154) formant des limites pour la rotation radiale et axiale de la plaque d'appui par rapport à ladite partie externe.

FIG 1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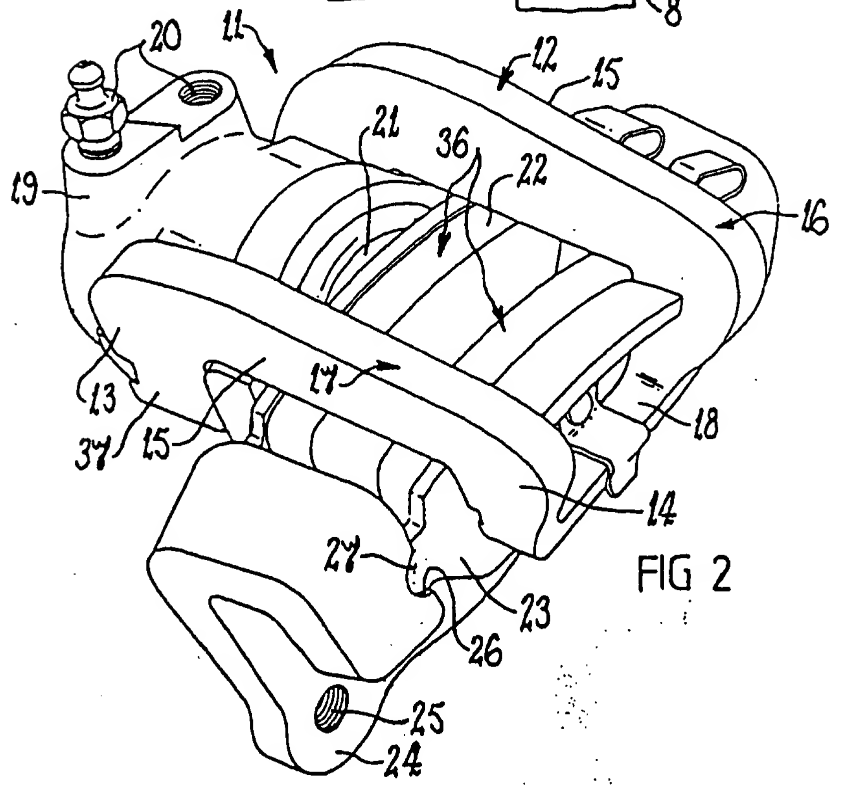
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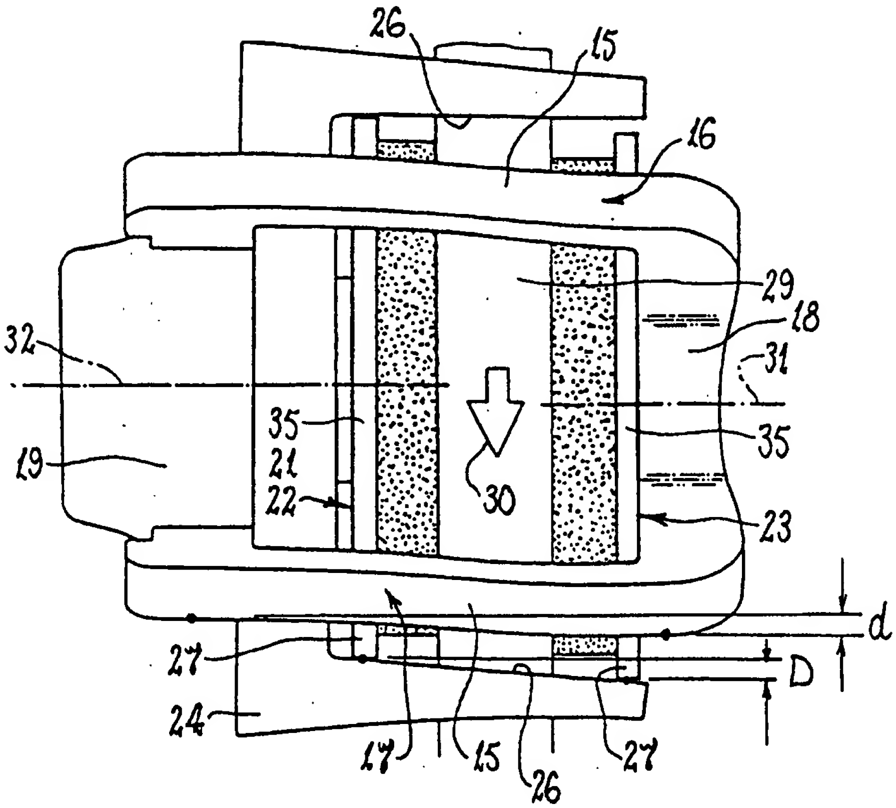
FIG 2



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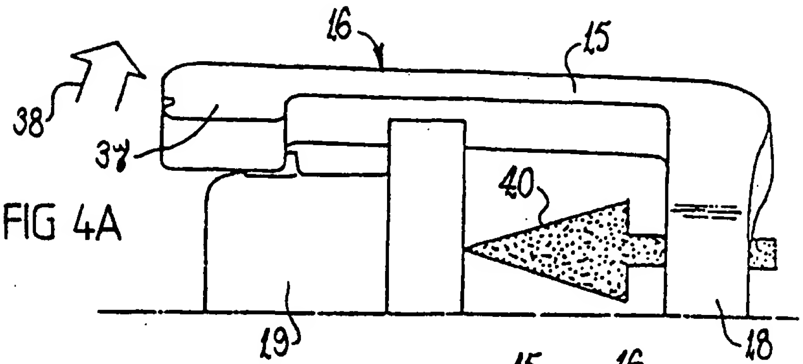

FIG 4A

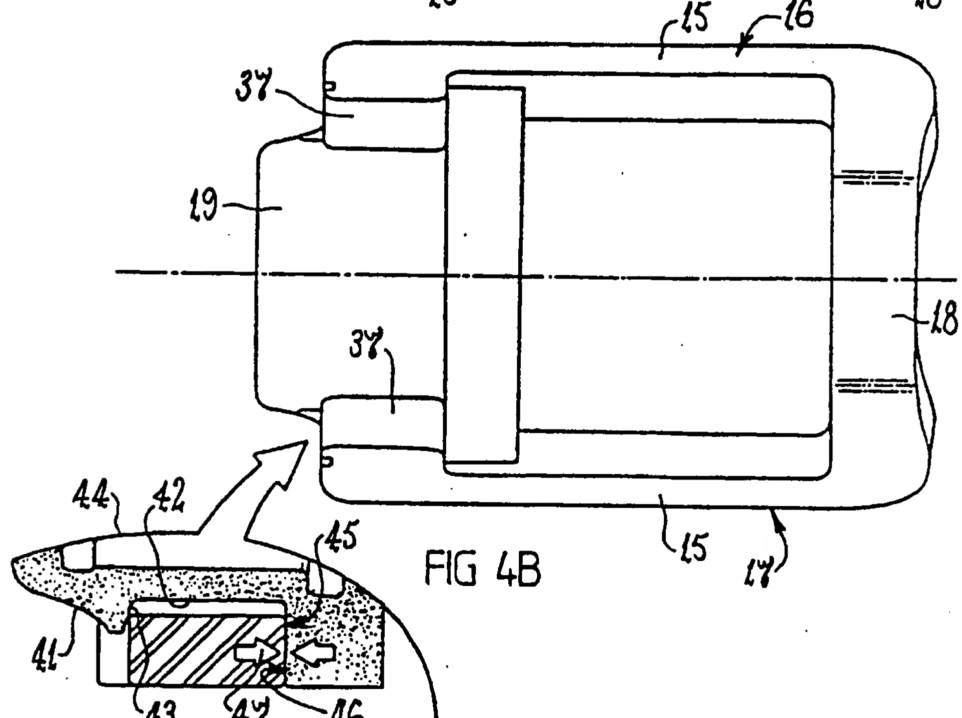

FIG 4B

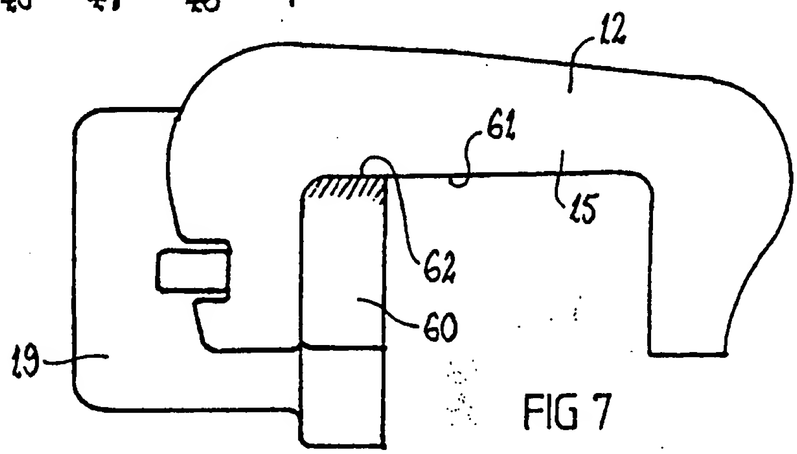

FIG 7

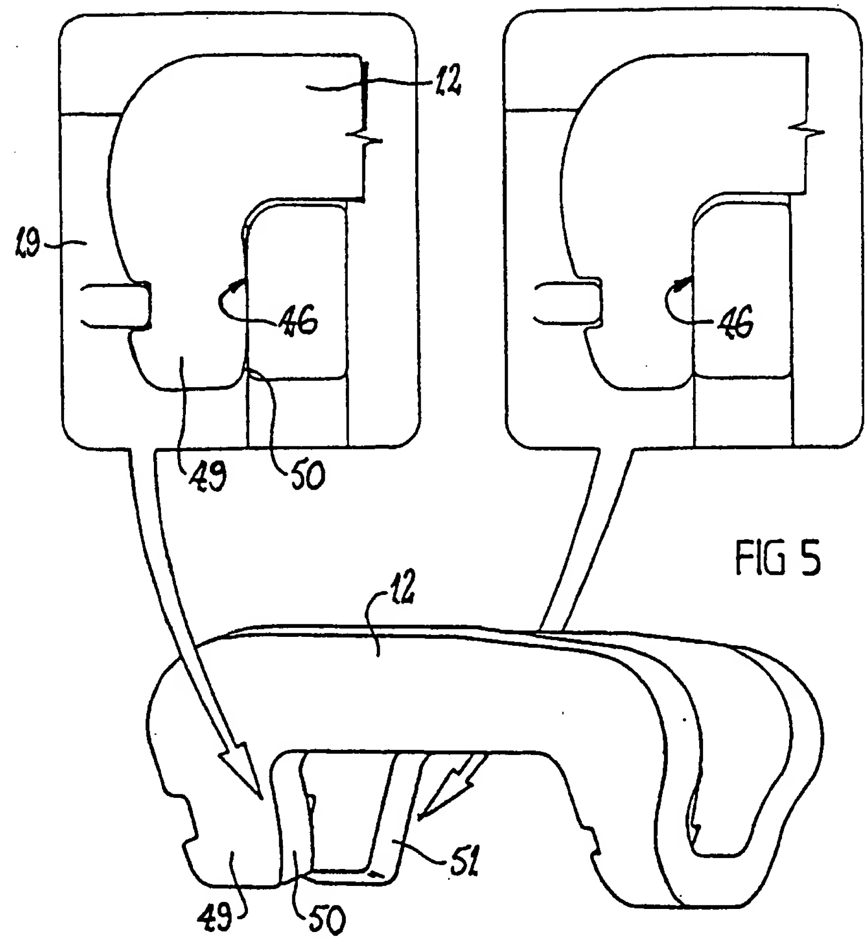

FIG 5

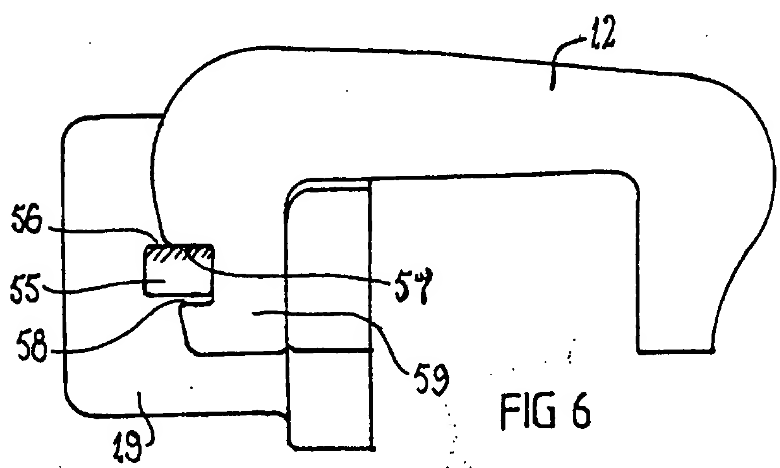

FIG 6

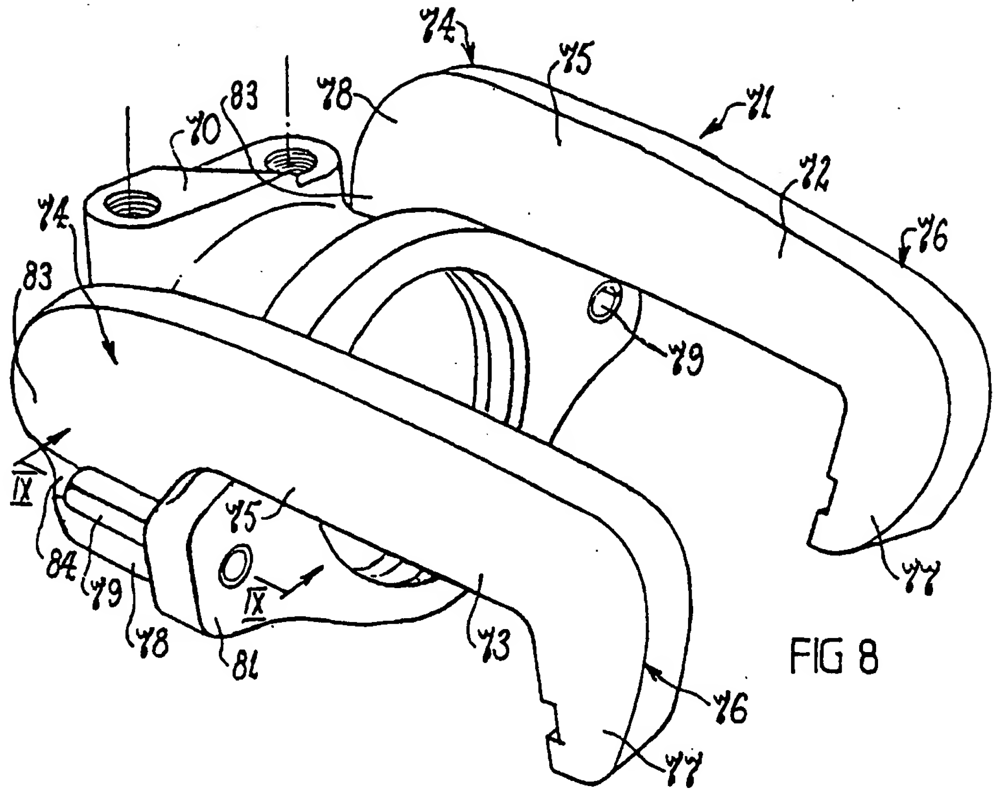
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FIG 8

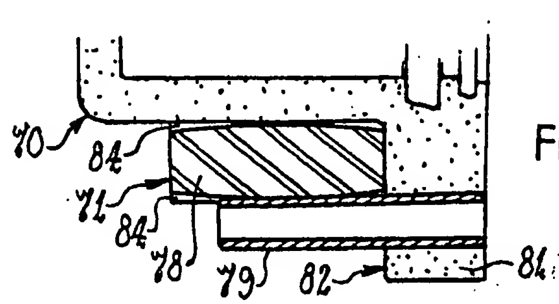
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FIG 9

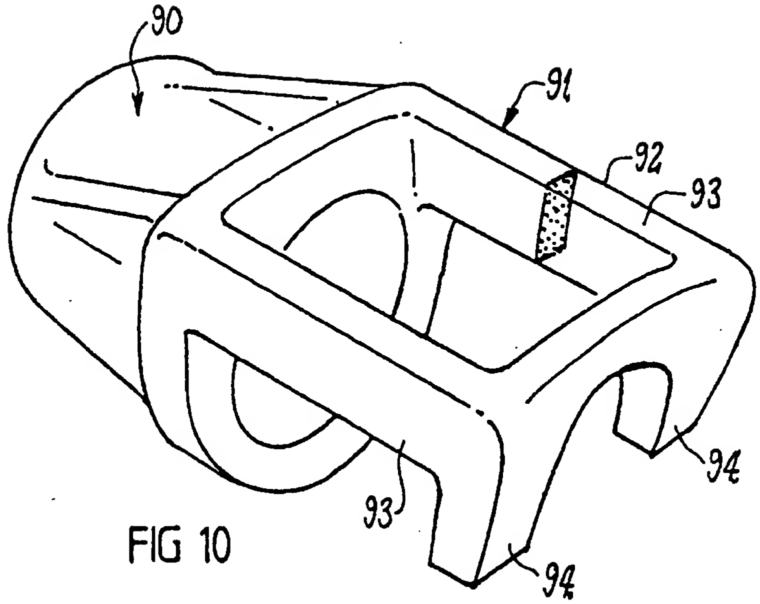

FIG 10

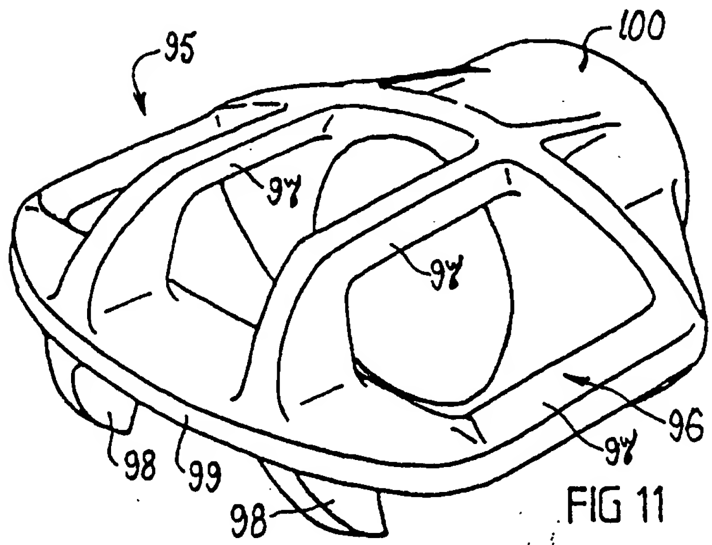

FIG 11

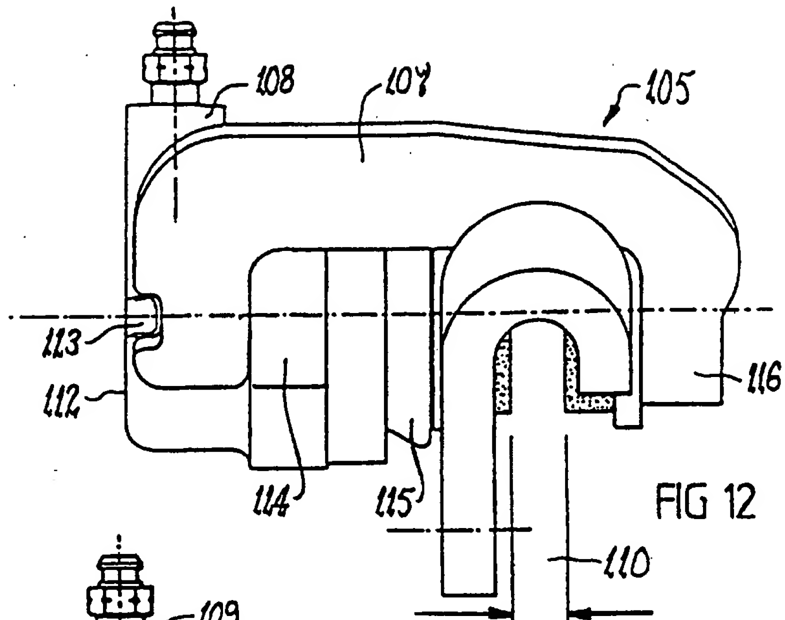

FIG 12

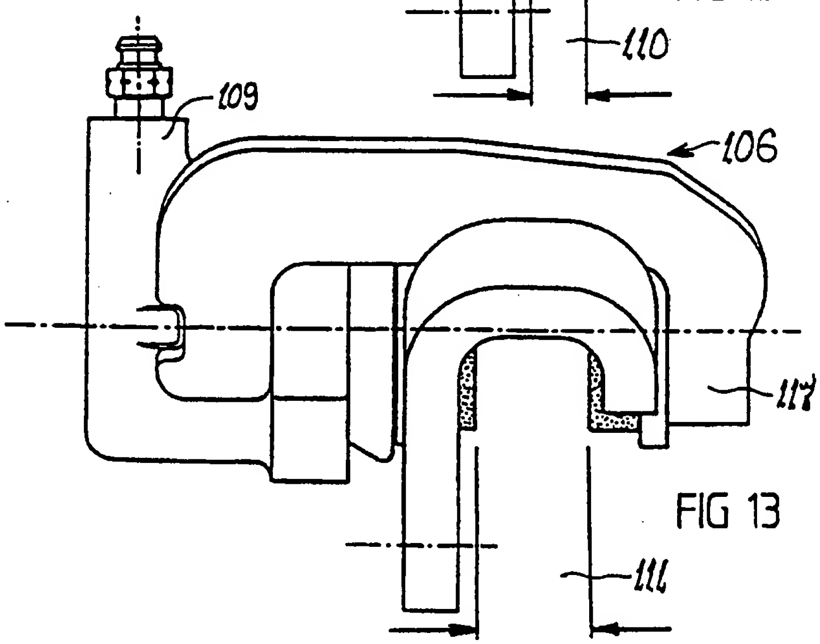

FIG 13

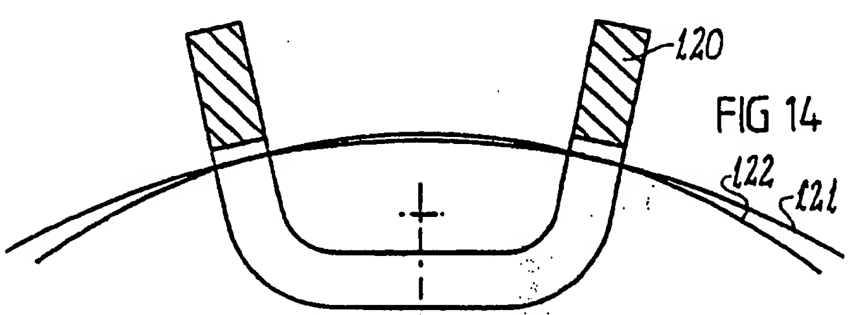

FIG 14

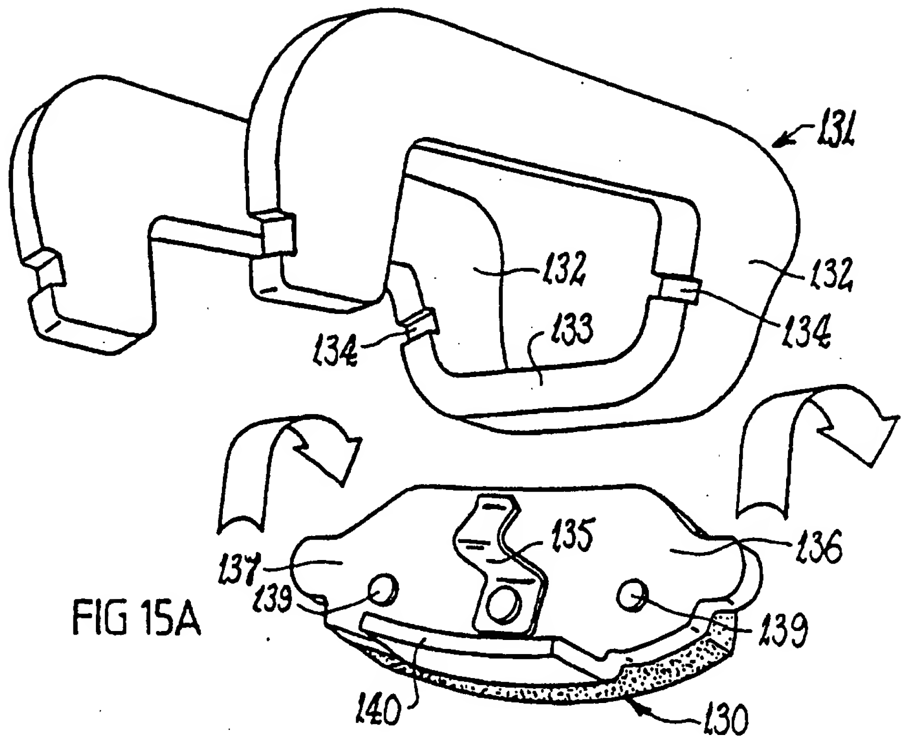

FIG 15A

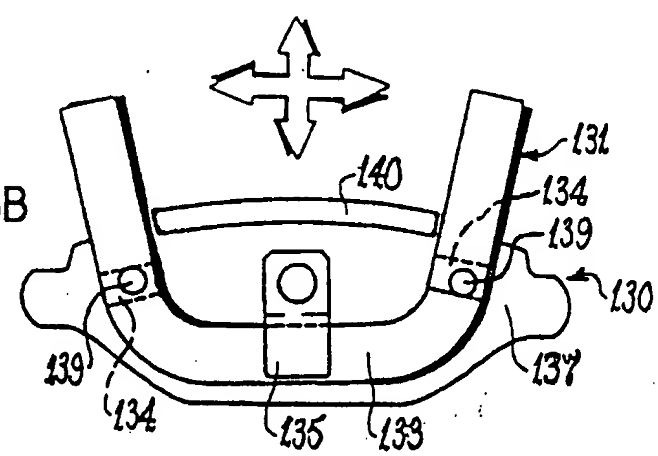

FIG 15B

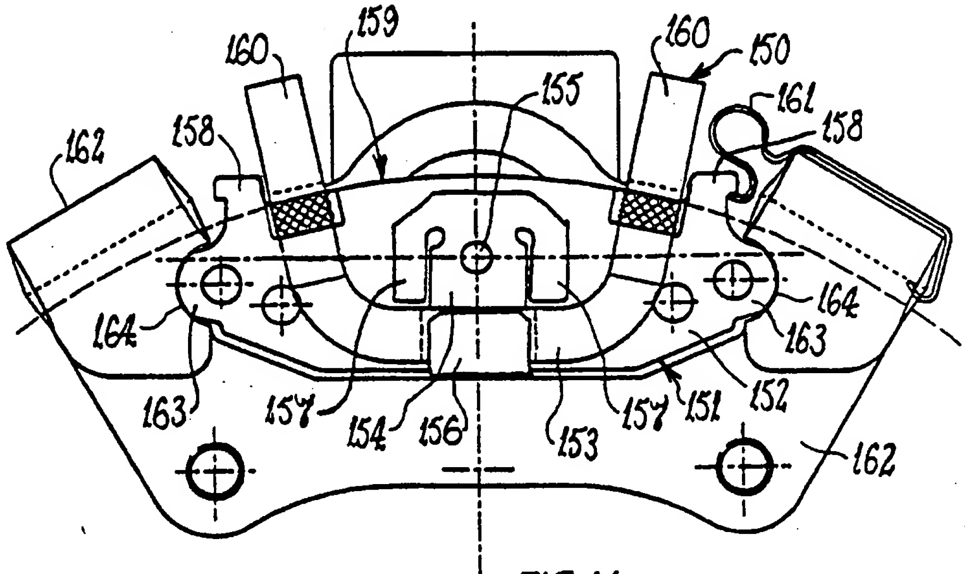
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FIG 16

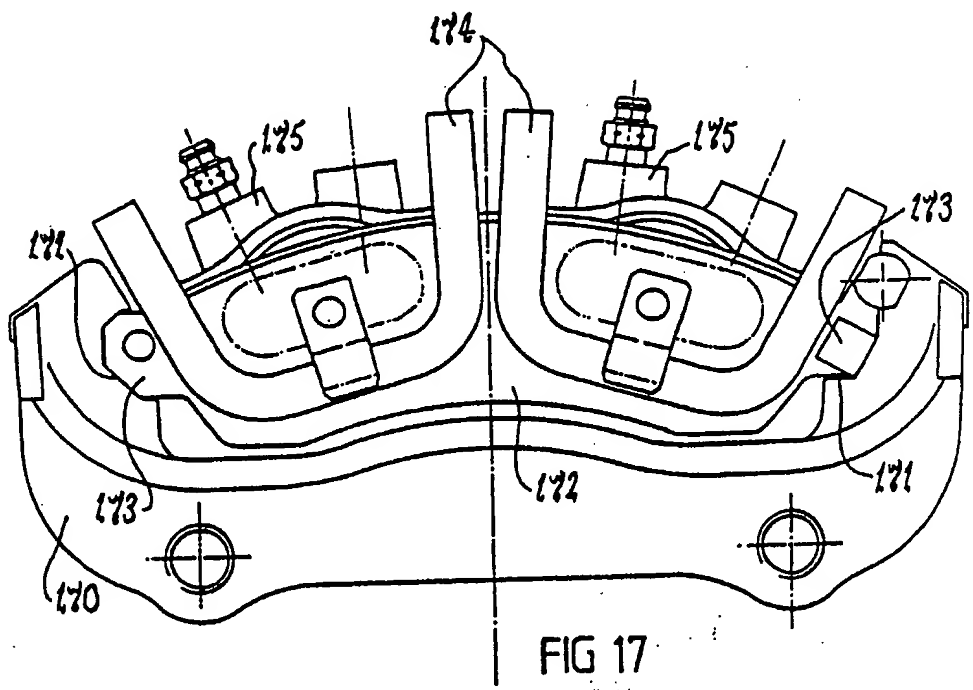
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FIG 17

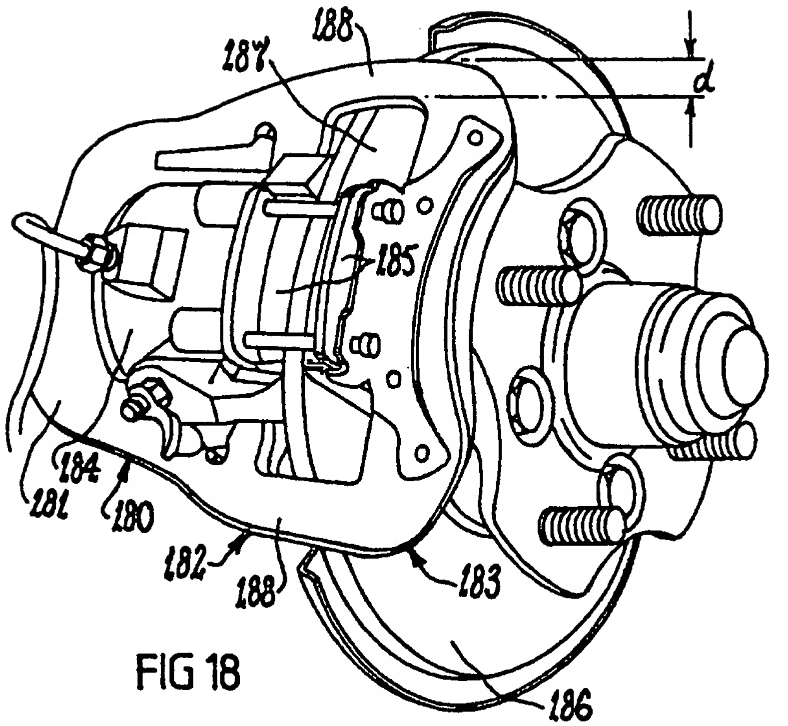

FIG 18